

# **МУК 2017/2018:**

Модели за управление на качеството.  
[Курс на базата на CMMI]

Software Quality Models  
[CMMI based course]

**Requirements Management (REQM), Project  
Planning (PP), Measurement and Analysis (MA),  
Process and Product Quality Assurance (PPQA)**

Dr. George Sharkov, Dr. Maya Stoeva

ESI Center Eastern Europe

[gesha@esicenter.bg](mailto:gesha@esicenter.bg) | [may\\_vast@yahoo.com](mailto:may_vast@yahoo.com)

[www.esicenter.bg](http://www.esicenter.bg)

# Информация, източници:

[www.esicenter.bg](http://www.esicenter.bg) >> general info and in “Resources”

links to CMMI models

<http://cmmiinstitute.com/cmmi-solutions/>

<http://www.sei.cmu.edu/cmmi/tools/index.cfm>

CMMI –DEV v 1.3 model (CMMI Institute, and SEI, Carnegie Mellon University)

<http://cmmiinstitute.com/resource/cmmi-for-development-version-1-3/>

[www.sei.cmu.edu/reports/10tr033.pdf](http://www.sei.cmu.edu/reports/10tr033.pdf)

General

[www.sei.cmu.edu](http://www.sei.cmu.edu)

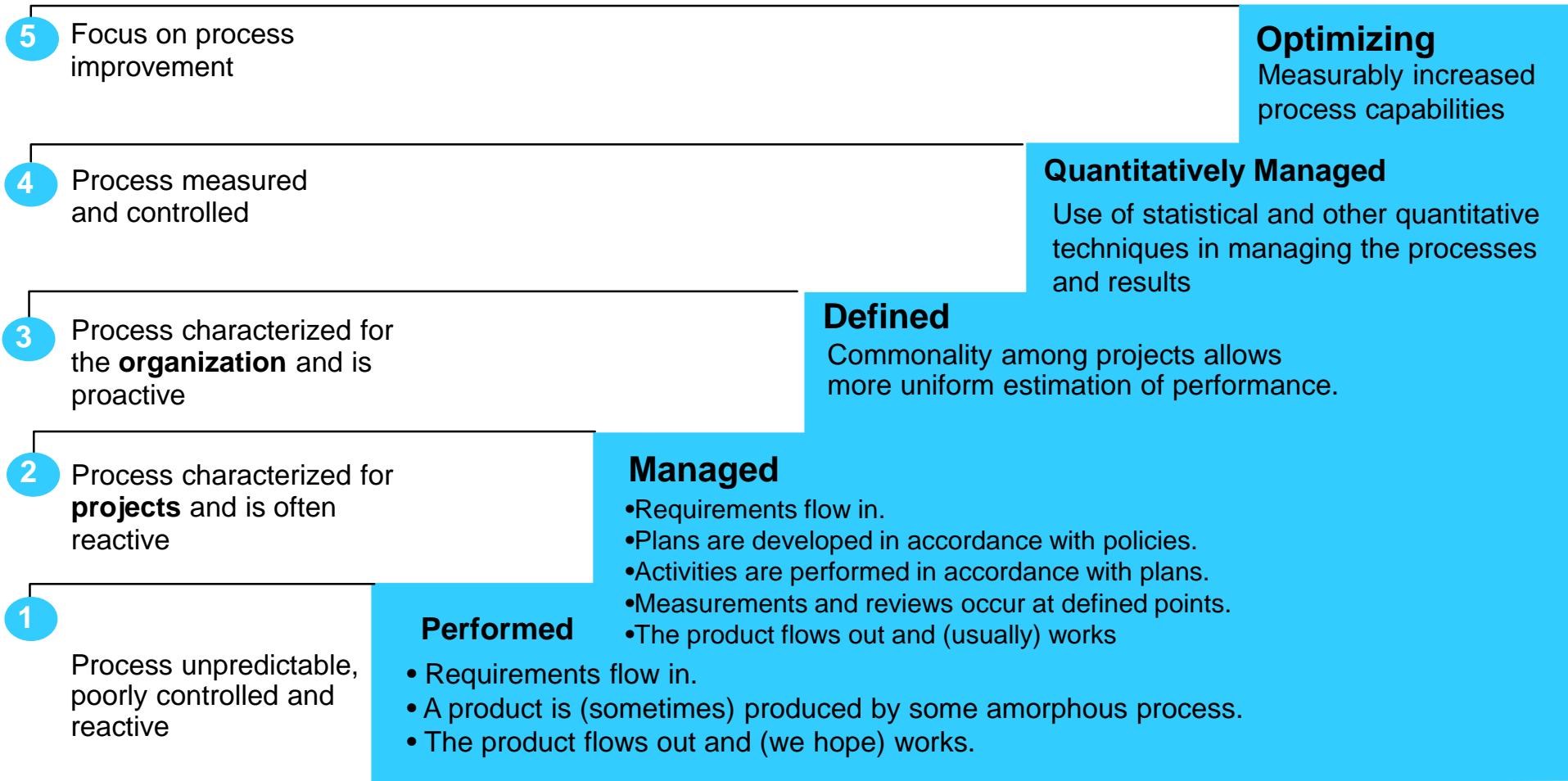
[www.cmmiinstitute.com](http://www.cmmiinstitute.com)

# Къде сме?

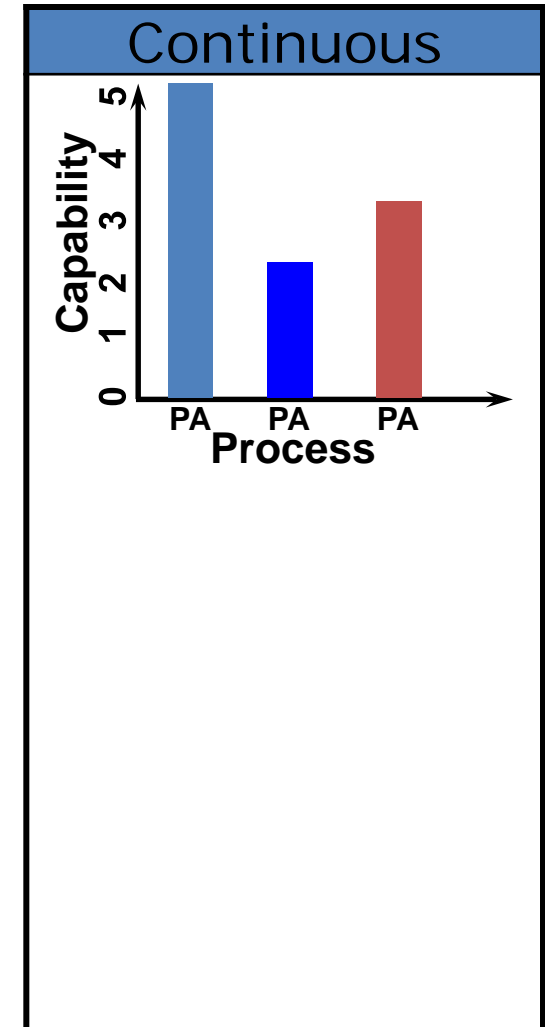
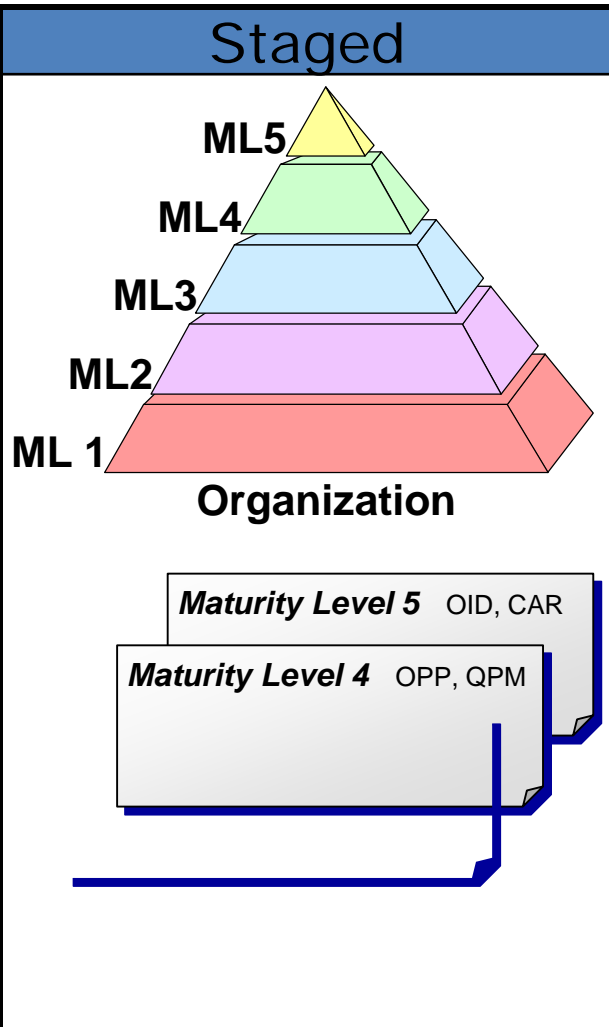
1	(balanced ScoreCards).
2	<p>CMMI (ver 1.3).</p> <p>– Maturity/Capability Continuous Staged representations. : Process Management, Project Management, Engineering, Support.</p>
3	<p><b>Процесни области от ниво 2 на CMMI. Детайлно представяне на:</b></p> <p><b>REQM – Requirements Management</b></p> <p><b>PP – Project Planning</b></p> <p><b>MA – Measurement and Analysis</b></p> <p><b>PPQA – Process and Product Quality Assurance</b></p> <p><b>CM – Configuration Management</b></p> <p><b>PMC – Project Monitoring and Control</b></p> <p><b>Преглед на: SAM-Supplier Agreement Management</b></p>
4	<p>3 CMMI.</p> <p>RD – Requirements Development</p> <p>VAL - Validation</p> <p>VER - Verification</p> <p>RSKM - Risk Management</p> <p>TS - Technical Solution</p> <p>: DAR - Decision Analysis and Resolution , IPM - Integrated Project Management , OPD - Organizational Process Definition , OPF - Organizational Process Focus, OT - Organizational Training , PI - Product Integration</p> <p>Maturity Level 4 5.</p> <p><b>Обобщение на връзките между процесните области: Tying all together</b></p>
5	<p>CMMI. – Agile CMMI, CMMI/ISO. CMMI –</p> <p>CMMI for Services, CMMI for Acquisition. (SCAMPI),</p>
6	– IT Mark. –

# CMMI (SEI/CMU) – reference model or **de facto** industrial standard

## CMMI-DEV, CMMI-ACQ, CMMI-SVC



# Remember: CMMI Representations



# ML2 GG&GPs

## **GG2: Institutionalize a Managed Process**

What should be applied to all PAs (from ML2 and up):

GP2.1: Establish an Organizational Policy

GP2.2: Plan the Process

GP2.3: Provide Resources

GP2.4: Assign Responsibility

GP2.5: Train People

GP2.6: Control Work Products

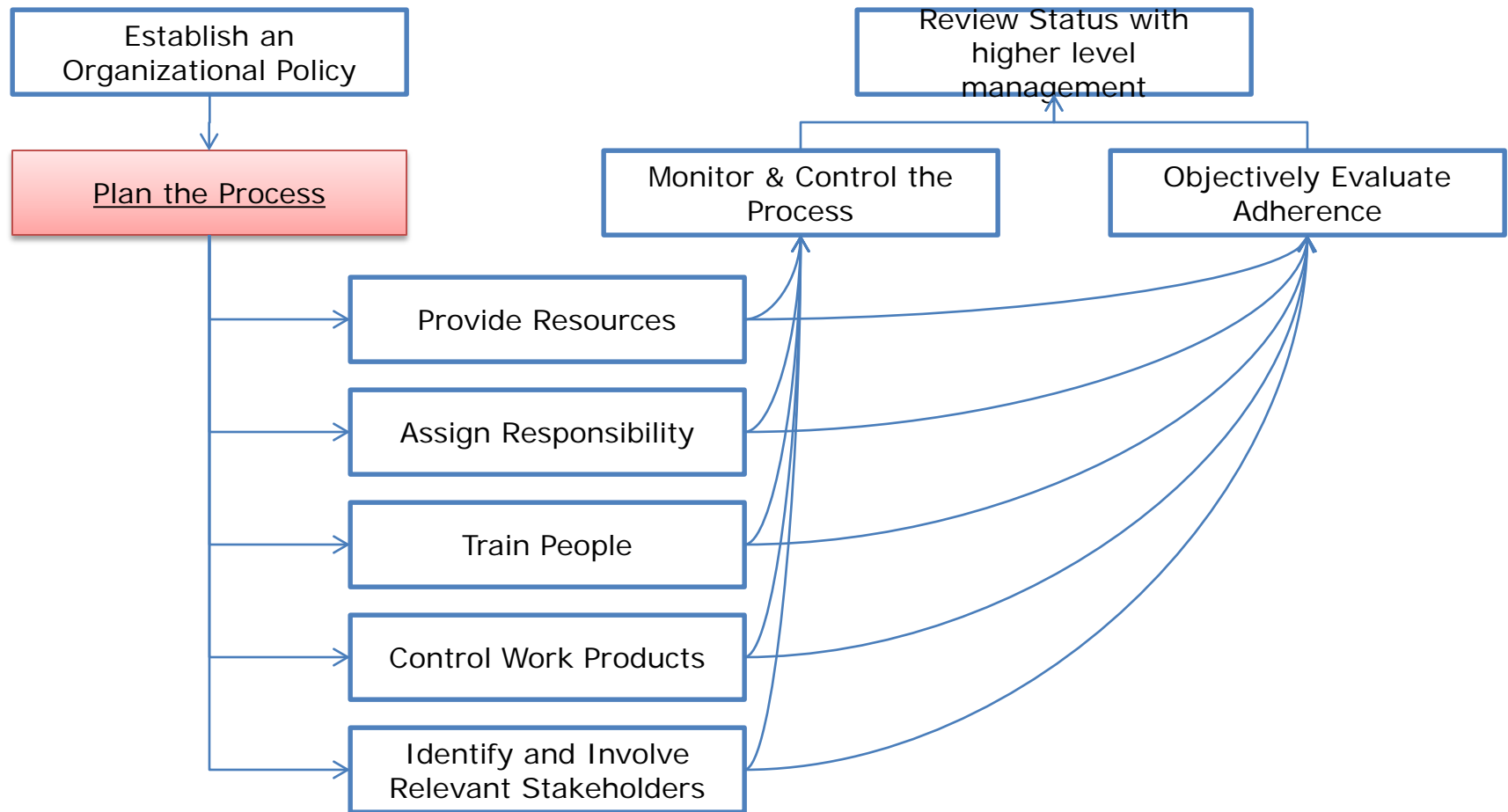
GP2.7: Identify and Involve Relevant Stakeholders

GP2.8: Monitor and Control the Process

GP2.9: Objectively Evaluate Adherence

GP2.10: Review Status with Higher Level Management

# How PAs relate to Generic Practices?



Source: Kiril Karaatanasov, ESI Center Bulgaria

# Note

A CMMI model is **not a process!**

A CMMI model describes the **characteristics of effective processes** and **"WHAT TO DO-s"**

**"All models are wrong,  
but some are useful."**

George Box  
(Quality and Statistics  
Engineer)





# ML2: **Управлението на проектите** **ВКЛЮЧВА**

Разбиране и спазване на **изискванията**

**Оценка на работа**, която трябва да се извърши

Разработване на **механизми, които спомогнат за**  
идентифициране на продуктите

Разработване на **план на проекта**

Предприемане на стъпки за **спазване на плана**

Работа с **доставчиците, за да установим** идентифицираните  
продукти

**Мониторинг на прогреса** спрямо плана

Определяне и анализ на **риска**

**Предприемане на действия** за справяне със **значителни**  
**отклонения** от плана

Предприемане на адекватни действия за  
**намаляване на риска**

# ML2: **Управлението на проектите**

## **ВКЛЮЧВА**

В случай, че даден проект се управлява с помощта на специфичните практики, свързани с конкретната процесна област, екипът разбира как и защо проектът е успешен. Това позволява на бъдещите подобни проекти да имат добри шансове за успеваемост като осигурява и повтаряемост на дейностите. Най-добрите практики за управление започват на нулево ниво от разработката на един проект и след това идеята е да се превърнат в рутина.

**Процесните области от ML2 са свързани с управлението на проекти (project management).**

Дисциплината управление на проекти води до разделянето на проекта на ясно определени етапи от жизнения цикъл на продукта, и до много по-голяма прозрачност в това управление, в границите на всеки етап.

# Project Management PAs (overview)

## Requirements management (REQM)

- **SG1: Manage requirements**

## Project Planning (PP)

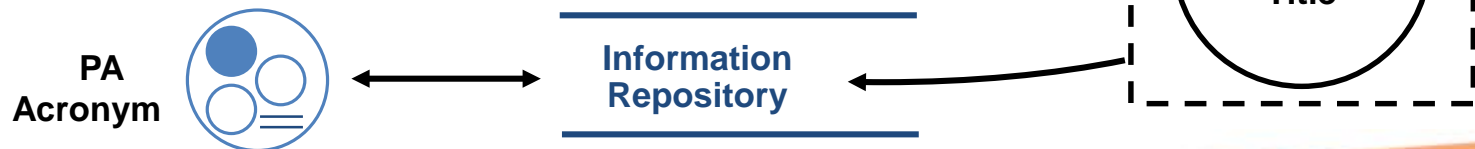
- SG1: Establish Estimates
- SG2: Develop a project plan
- SG3: Obtain Commitment to the plan

## Project Monitoring and Control (PMC)

- SG1: Monitor Project Against Plan
- SG2: Manage Corrective action to closure

# Context Diagrams

- Intended to show graphical mapping of practices to goals
- Not intended as a data flow diagram
- Not intended to show exhaustive relationships within a process area

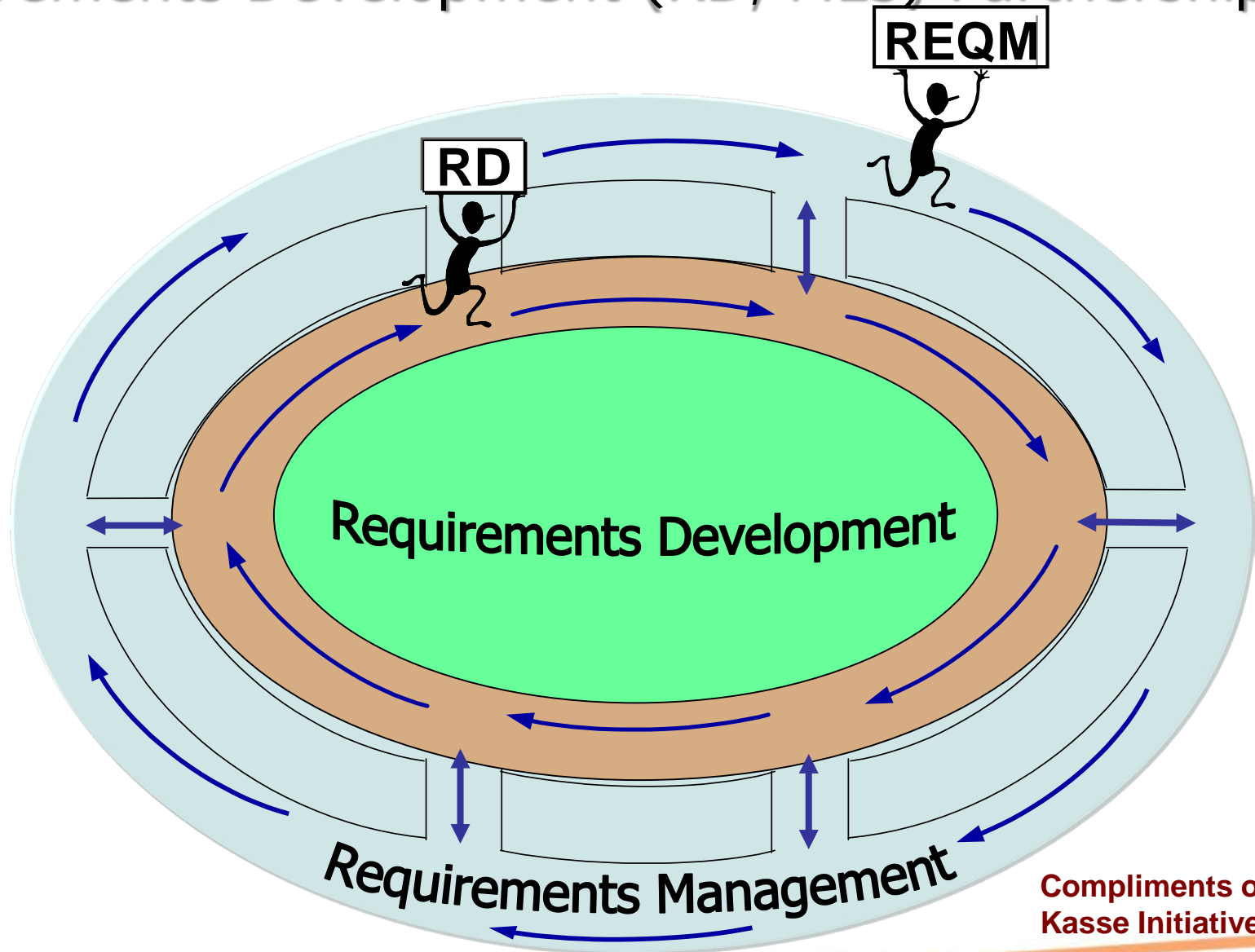


# Think about: What Product/SW Development Needs?

Establishing and maintaining sets of requirements

- customer requirements
- product requirements
- product component requirements
- managing the requirements as the product evolves

# The Requirements Management (REQM, ML2) and Requirements Development (RD, ML3) Partnership



Compliments of  
Kasse Initiatives, LLC

# Requirements Management (REQM)

*The purpose of Requirements Management (REQM) is to **manage the requirements** of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products.*



## SG1: Manage Requirements

Requirements are managed and inconsistencies with project plans and work products are identified.

*The process area also has generic goals to support institutionalization.*

# When Requirements Management Is Not Done Well...

Requirements are accepted by staff from **any source** they deem to be authoritative.

The project experiences a high level of **requirements changes**.

There are high **levels of rework** throughout the project.

There is an inability to prove that **the product meets the approved requirements**.

Lack of requirements traceability often results in **incomplete or incorrect testing** of the product.



# Relevant Terminology

## Requirements traceability

A discernable association between requirements and related requirements, implementations, and verifications.

## Bidirectional traceability

An association among two or more logical entities that is discernable in either direction (i.e., to and from an entity).

# Requirements Management (REQM) Specific Practices

SP 1.1 Obtain an **Understanding** of Requirements

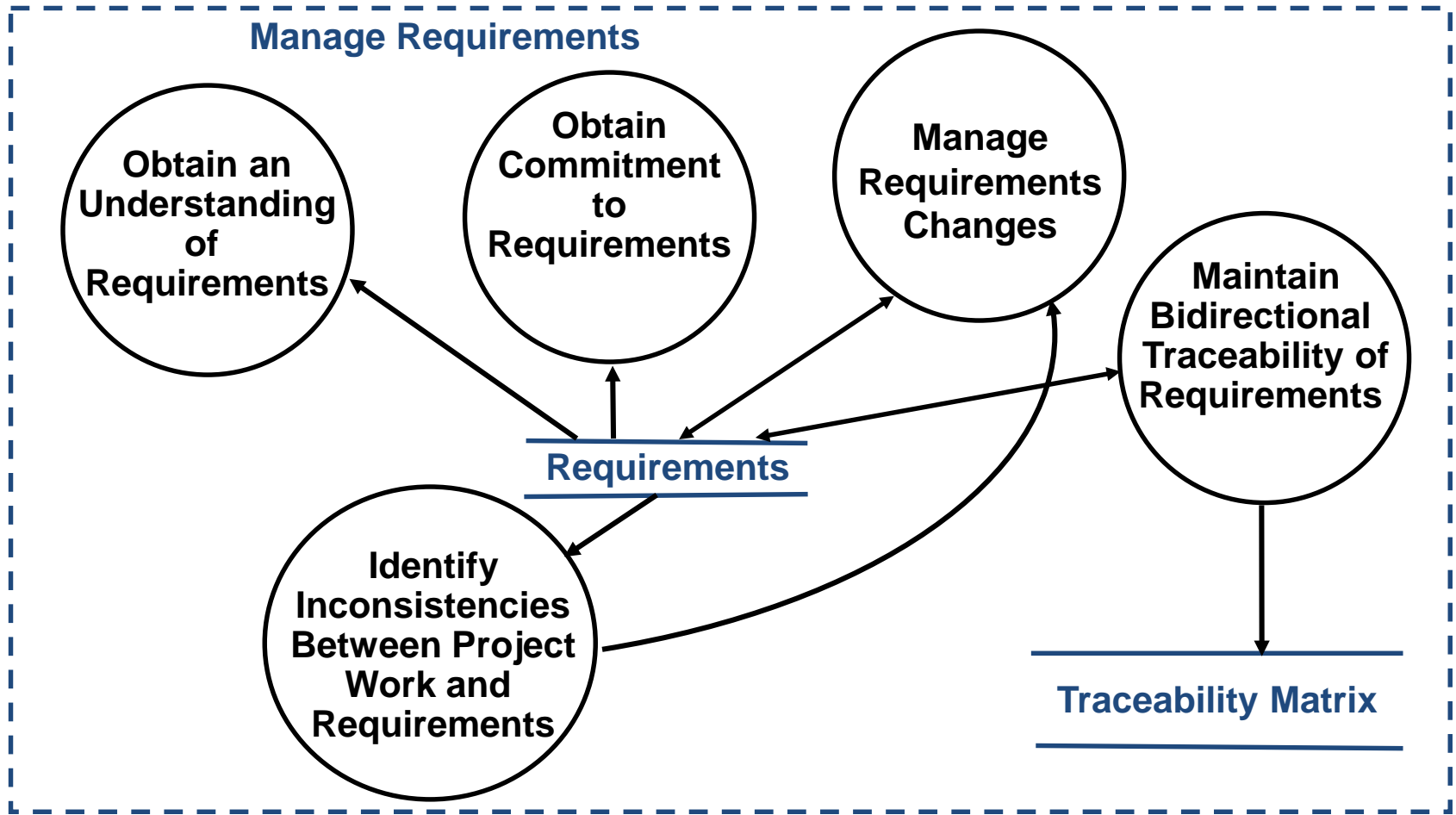
SP 1.2 Obtain **Commitment** to Requirements

SP 1.3 Manage Requirements **Changes**

SP 1.4 Maintain **Bidirectional Traceability** of Requirements

SP 1.5 **Identify Inconsistencies** between project work and requirements

# Requirements Management Context



# REQM Practices implementation:

- Acceptance criteria in place?
- Requirements comply to criteria?
- Is understanding reached and is it documented? How?
- Who are the relevant stakeholders?
- Did they agree to requirements?
- Is the commitment documented? How?
- All requirements and their changes documented?
- Requirements change history and rationale documented?
- Are changes evaluated by affected stake holders?
- Bi-directional traceability among the requirements and the project plans and work products maintained?
- Are the project plan/activities/work products reviewed to assess the consistency with the (changed) requirements?
- If inconsistencies have been are corrective actions initiated to solve them?

# Remember:

## Why do we need **bidirectional traceability**???

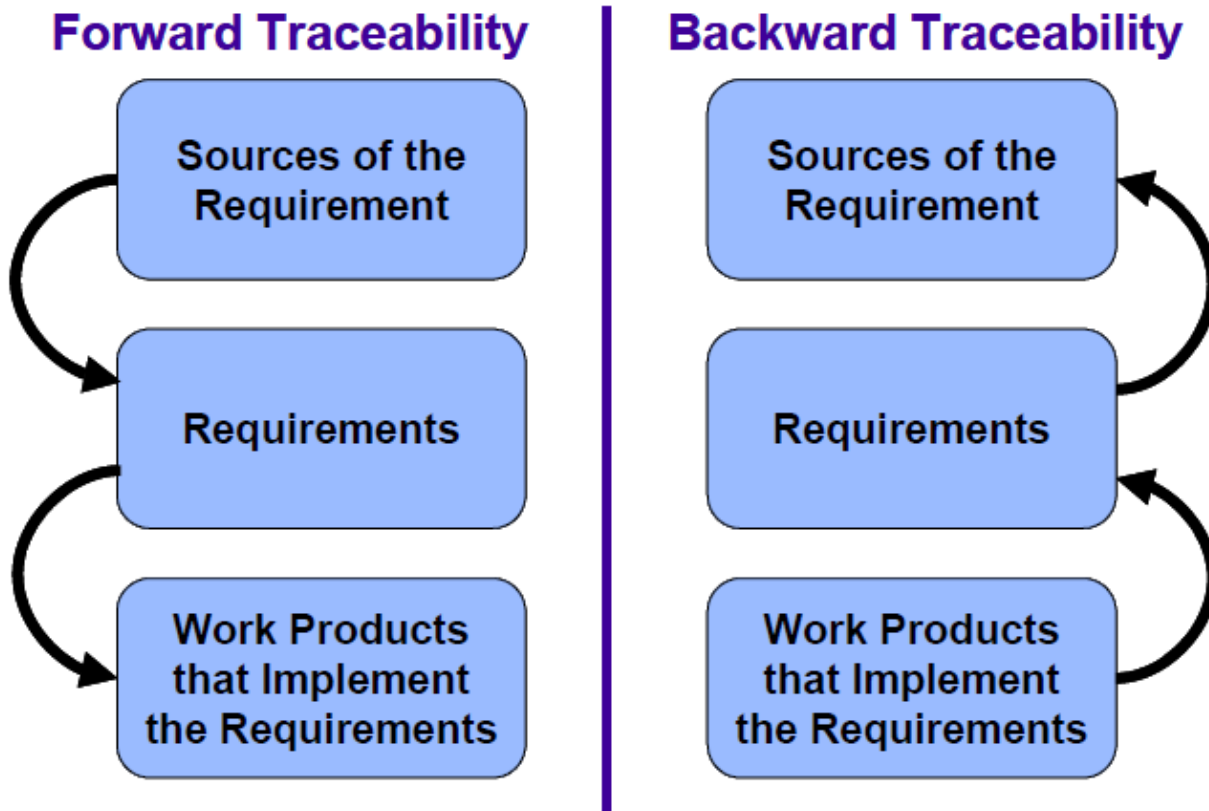


Figure 1: Bidirectional (Forward & Backward) Traceability

### Benefits:

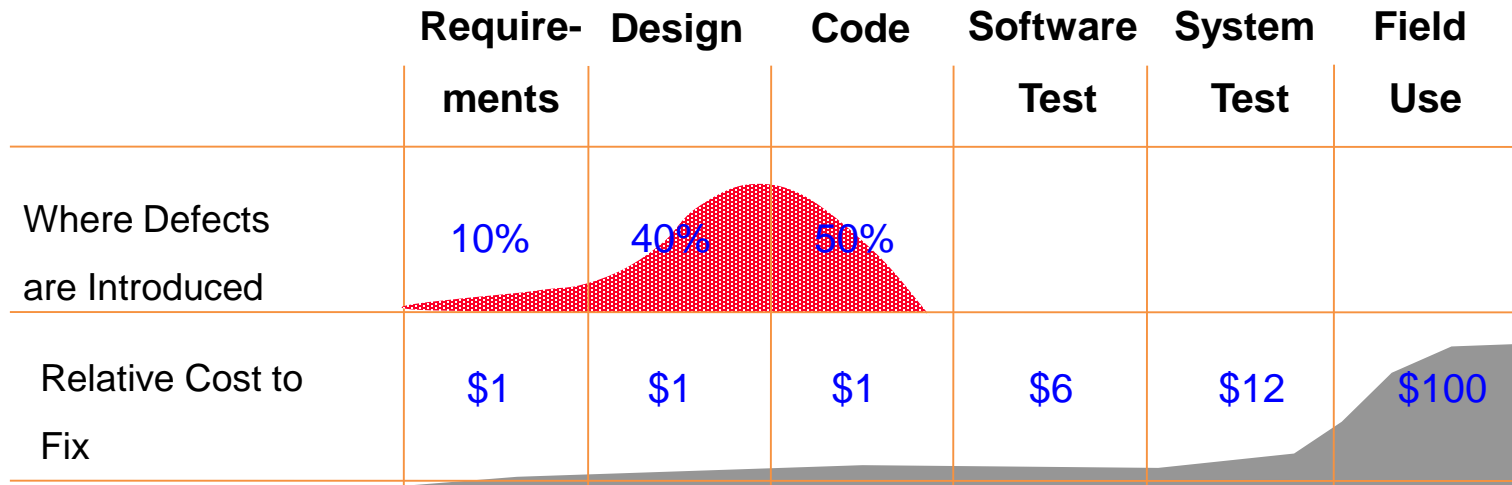
#### Analyze the impact of a change

- All **work products affected** by a changed requirement
- All **requirements affected** by a change or defect in a work product

#### Assess current status of the requirements and the project

- Identify **missing** requirements
- Identify **gold plating** (overdoing)

# Defects : Insertion Pattern & Cost of Removal



Source: SEPG Asia Pacific 2009  
presented by Ravindra Nath, KUGLER MAAG CIE GmbH

# Sampling the Generic Practices

## GP 2.1: Establish an Organizational Policy

Establish and maintain an organizational policy for planning and performing the requirements management process.

### *Elaboration for Requirements Management*

This policy establishes organizational expectations for managing requirements and identifying inconsistencies between the requirements and the project plans and work products.

# Sampling the Generic Practices

## GP 2.3: Provide resources

*Provide adequate resources for performing the requirements management process, developing the work products, and providing the services of the process.*

### *Elaboration for Requirements Management*

Examples of resources provided include the following tools:

- **Requirements tracking tools**
- **Traceability tools**



# Sampling the Generic Practices

## GP 2.6: Manage Work Products (Configurations)

*Place designated work products of the requirements management process under appropriate levels of control.*

### *Elaboration for Requirements Management*

Examples of work products placed under control include the following:

- Requirements
- **Requirements traceability matrix**

# Sampling the Generic Practices

## GP 2.7: Identify and Involve relevant Stakeholders

*Identify and involve the relevant stakeholders of the requirements management process as planned.*

### *Elaboration for Requirements Management*

Select relevant stakeholders from customers, end users, developers, producers, testers, suppliers, marketers, maintainers, disposal personnel, and others who **may be affected by, or may affect**, the product as well as the process.

Examples of activities for **stakeholder involvement** include the following:

- **Resolving issues on the understanding of the requirements**
- **Assessing the impact of requirements changes**
- **Communicating the bidirectional traceability**
- **Identifying inconsistencies among project plans, work products, and requirements**

# Sampling the Generic Practices

## GP 2.8: Monitor and Control the process

*Monitor and control the requirements management process against the plan for performing the process and take appropriate corrective action.*

### *Elaboration for Requirements Management*

Examples of measures and work products used in monitoring and controlling include the following:

- Requirements volatility (percentage of requirements changed)
- Schedule for coordination of requirements
- Schedule for analysis of a proposed requirements change

# Sampling the Generic Practices

## GP 2.9: Objectively Evaluate Adherence

*Objectively evaluate adherence of the requirements management process against its process description, standards, and procedures, and address noncompliance.*

### *Elaboration for Requirements Management*

Examples of activities reviewed include the following:

- Managing requirements
- Identifying inconsistencies among project plans, work products, and requirements

Examples of work products reviewed include the following:

- Requirements
- Requirements traceability matrix

# Sampling the Generic Practices

## GP 2.10: Review Status with Higher Level Management

*Review the activities, status, and results of the requirements management process with higher level management and resolve issues.*

### *Elaboration for Requirements Management*

Proposed changes to **commitments to be made external to the organization** are reviewed with higher level management to ensure that all commitments **can be accomplished**.

# Project Management PAs (overview)

## Requirements management (REQM)

- SG1: Manage requirements

## Project Planning (PP)

- **SG1: Establish Estimates** (*Създаване на оценките*)
- **SG2: Develop a project plan** (*Разработка на плана*)
- **SG3: Obtain Commitment to the plan** (*Осигуряване на ангажиментите към плана*)

## Project Monitoring and Control (PMC)

- SG1: Monitor Project Against Plan
- SG2: Manage Corrective action to closure

# Think about: What a typical Project Plan includes?

- Resources
- Budget
- Schedule (Milestones)
- Stakeholders
- Commitments – dependencies, deliverables
- Data Plan
- Knowledge and skills - Training
- Risks

# PP: Project Planning

*The purpose of Project Planning (PP) is to **establish and maintain plans** that define project activities.*



## SG1: Establish Estimates

Estimates of project planning parameters are established and maintained.

## SG2: Develop a Project Plan

A project plan is established and maintained as the basis for managing the project.

## SG3: Obtain Commitment to the Plan

Commitments to the project plan are established and maintained.



# PP: Project Planning

*... Как се определя обхвата на работа с помощта на WBS*

*... Как се установява размера на усилията, които ще се изискват за изпълнение на плана и цената, която трябва да се заплати*

*... За какво се използва жизненият цикъл на продукта*

*... Как се разработва project plan-а (бюджет, графици, рискове, адекватна информация, ресурси, нужди от знания и умения, включени участници)*

*... Как се осигурява спазването на ангажиментите към плана (reviews, reconciling work and resource levels)*

*... Какви критерии се използват за установяване на коригиращите действия (corrective actions), нужни за отстраняване на съществени отклонения от плана (significant deviations)*

# When Project Planning Is Not Done Well...

**Оценките** на различните части от проекта са неточни.

Трудно е да се **идентифицират отклонения** от лошо документирани планове.

**Ресурсите** не са на разположение/използвани, когато са необходими.

Бъдещите проекти не могат да се поучат от готови проекти, тъй като **няма направени изводи**.

# Да помислим...

*... Какво може да се случи, когато планирането на проекта не се изпълнява добре?*

*... Собствен опит при подобни отклонения от плана?*

*... Какви са ползите от доброто планиране на проекта за организацията?*

# Специализирана терминология

## Project

A managed set of interrelated resources which delivers one or more products to a customer or end user. A project has a definite beginning (i.e., project startup) and typically operates according to a plan. Such a plan is frequently documented and specifies what is to be delivered or implemented, the resources and funds to be used, the work to be done, and a schedule for doing the work. A project can be composed of projects.

## Program

(1) A project. (2) A collection of related projects and the infrastructure that supports them, including objectives, methods, activities, plans, and success measures.

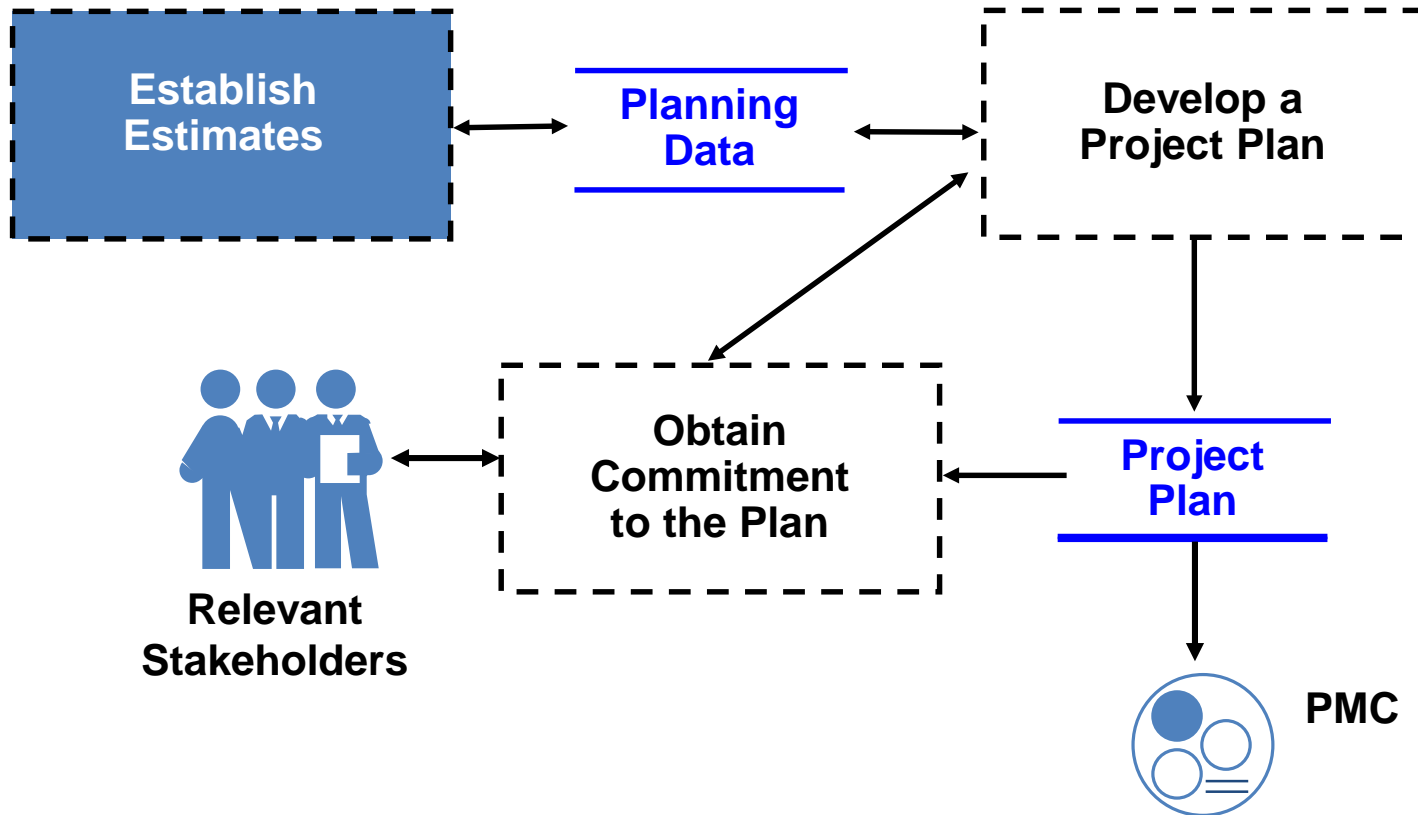
## Work breakdown structure (WBS)

An arrangement of work elements and their relationship to each other and to the end product.



WBS

# Project Planning Context -1



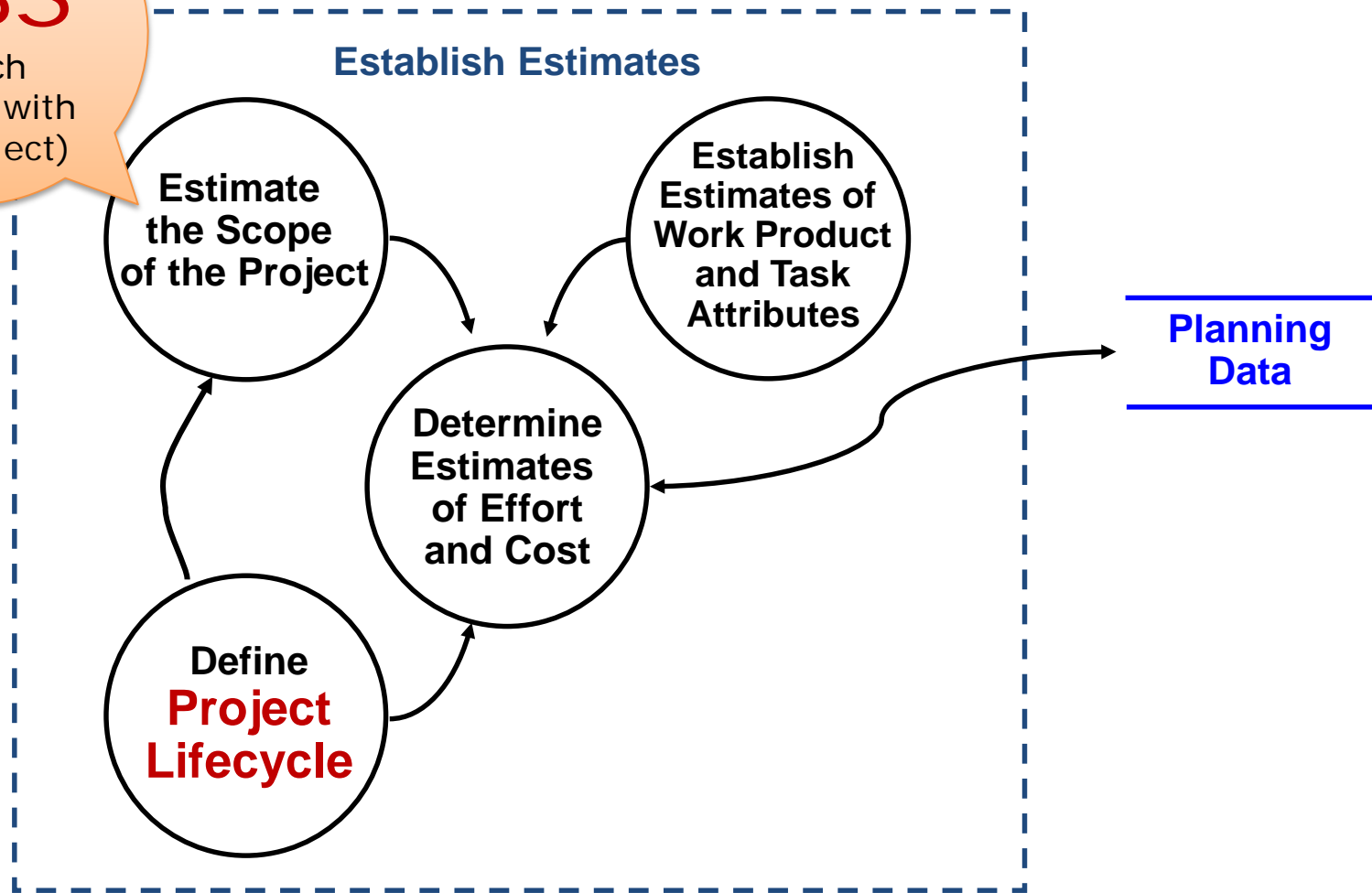
Показаните три кутийки директно отговарят на трите специфични цели на Project planning. На следващия слайд е показано кои специфични практики се използват за осъществяването на всяка цел. Последващите класациите ще подчертаят специфичните практики, които да съответстват на всяка цел / афинитет кутия. Имайте предвид, че полето в сиво е този, който ще бъде разгледан по-нататък.

# Project Planning Context -2

Starts with

## WBS

(which evolves with the project)



# Project Planning Context -2

**SP 1.1 “Estimate the Scope of the Project”** - Estimating the scope of the project involves establishing work breakdown structures (WBSs) that divide the overall project into work packages. A work package represents a single work unit that can be separately assigned, performed, and tracked. The WBS provides a reference and organizational mechanism for assigning effort, schedule, and responsibility. It is used as the underlying framework to plan, organize, and control the work done on the project. The WBS evolves with the project.

**SP 1.2 “Establish Estimates of Work Product and Task Attributes”** - Product and task attributes include parameters such as size and complexity. Estimating attributes involves both determining the technical approach of the project and using appropriate methods to determine the work product and task attributes that will be used to estimate resource requirements.

# Project Planning Context -2

**SP 1.3 “Define Project Lifecycle”** - The project lifecycle phases need to be defined depending on the scope of requirements, the estimates for project resources, and the nature of the project. Larger projects may contain multiple phases such as concept exploration, development, production, operations, and disposal. Within these phases, sub-phases may be needed. A development phase may include subphases such as requirements analysis, design, fabrication, integration, and verification. Emphasize that phases in the lifecycle should be of manageable size and the boundaries between phases should represent logical decision points during which course corrections and determinations of future scope and cost can be made.



# Project Planning Context -2

**SP 1.4 “Determine Estimates of Effort and Cost”** - Determining estimates of effort and cost involves using planning parameters, models, and historical data to develop estimates for cost, schedule and effort. Models and historical data are applied to the size, activities, and other planning parameters to determine effort and cost. Historical data include the cost, effort, and schedule data from previously executed projects plus appropriate scaling parameters to account for differing project sizes and complexities. Unprecedented efforts present more risk, require more research to develop a reasonable basis of estimate, and require more management reserve.



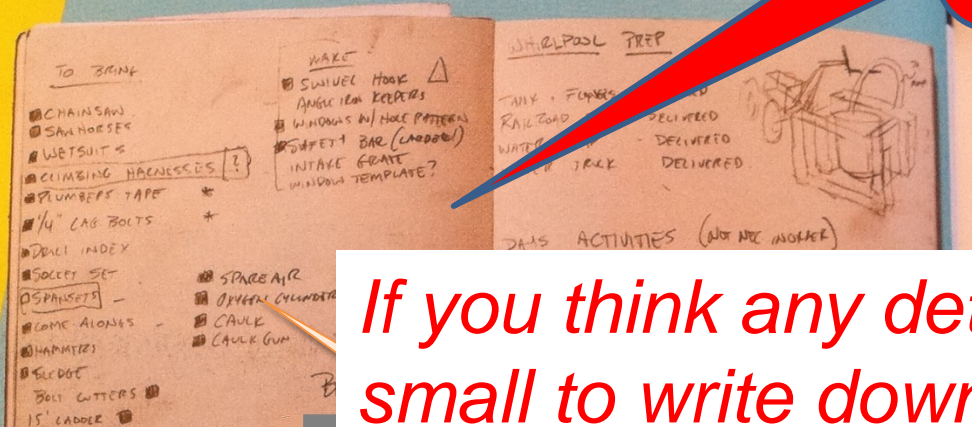
ADAM SAVAGE'S WORKSHOP

# Step One: Make a List

*If you think any detail is too small to write down in your initial project plan, you're going to get it wrong.*

I love lists. Always have. When I was 14, I wrote down every dirty word I knew on file cards and placed them in alphabetical order. I have a thing about collections, and a list is a collection with purpose.

Lists are how I parse and manage the world. I make lists for fun (I have more than 17,000 palindromes) and to relax (I can eliminate distractions and focus on what's important). But mostly I make lists for projects. This can be daunting. Breaking something big into its constituent parts will help you organize your thoughts, but it can also force you to confront the depth of your ignorance and the hugeness of the task.

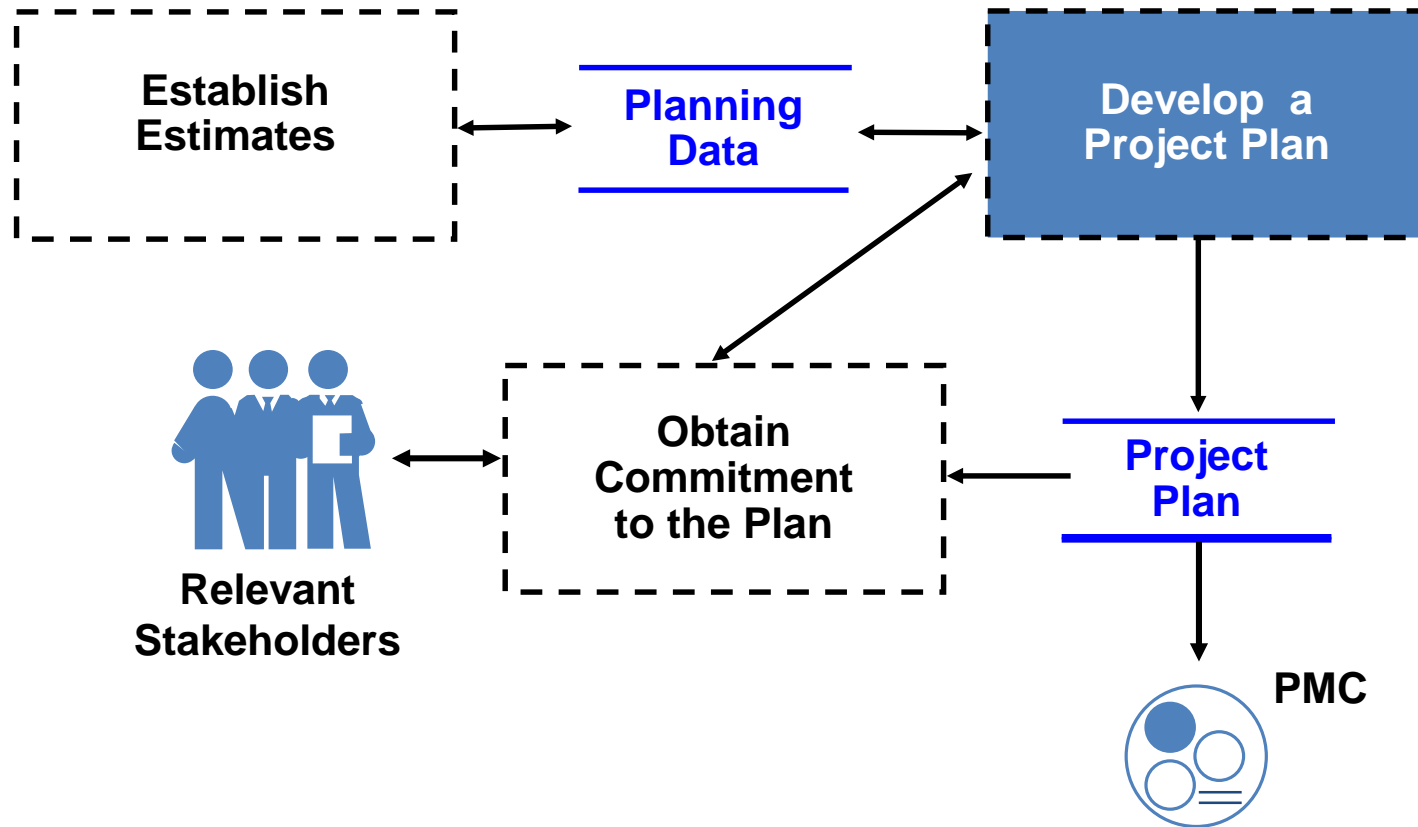


What is this?

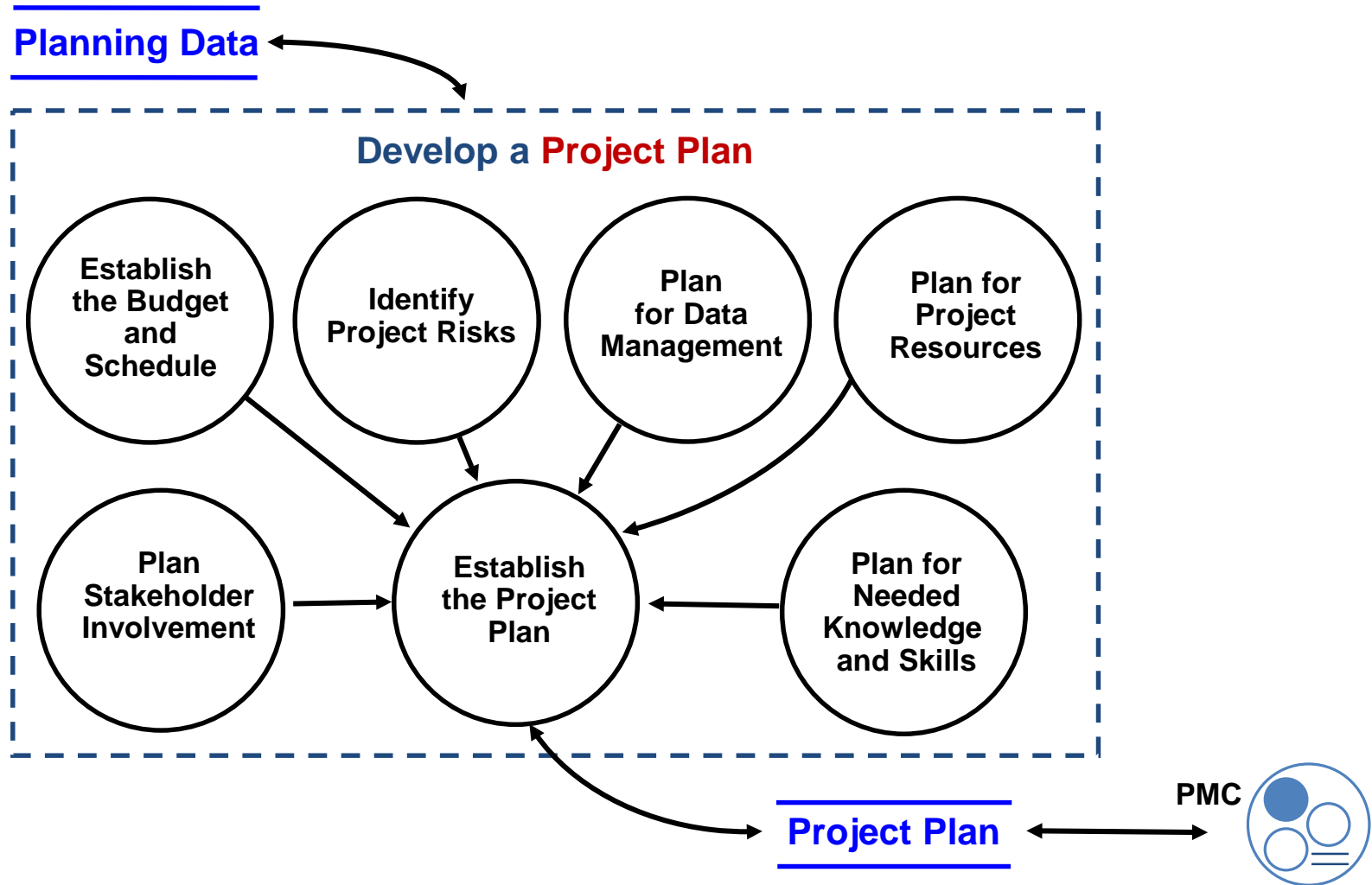
*If you think any detail is too small to write down in your initial project plan, you're going to get it wrong.*

WBS ?

# Project Planning Context -3



# Project Planning Context -4



# Project Planning Context -4

## SP 2.1 “Establish the Budget and Schedule”

Schedule attaches the key lifecycle decision points to actual calendar dates based on factors such as the availability of resources and dependencies on other efforts. The criteria for determining when a schedule or budget item is in trouble are also developed at this time based on timing constraints, history, project assumptions, and work to be accomplished. Corrective actions may require replanning, which may include revising the original plan, establishing new agreements, or adding mitigation activities to the current plan.

# Project Planning Context -4

## SP 2.2 “Identify Project Risks”

Risks are identified or discovered and analyzed to support project planning, and then are handed off to risk management activities. Project planning risk identification and analysis includes eliciting risks with the associated contextual information, documenting the risks, obtaining agreement on the completeness and correctness of the documented risks from relevant stakeholders, prioritizing risks, and revising the risks as appropriate. The risks are identified and prioritized in this practice. Tracking and mitigation risks is done in the Risk Management PA.

# Project Planning Context -4

**SP 2.3 “Plan for Data Management”** - Planning for data management involves establishing the requirements and procedures to ensure privacy and security of the data; establishing a mechanism to access archived data; and determining the project data to be identified, collected, and distributed. Document the reasons for collecting the data along with the master list of data to be managed. Note: Data Management may be a new concept to many attendees. You may want to brainstorm about what the differences are between the items that go into data management vs. configuration management. Can some go in both?

**SP 2.4 “Plan for Project Resources”** - The top-level WBS developed earlier as an estimation mechanism is expanded by decomposing the top-level tasks into work packages that represent singular work units that can be separately assigned, performed, and tracked.



# Project Planning Context -4

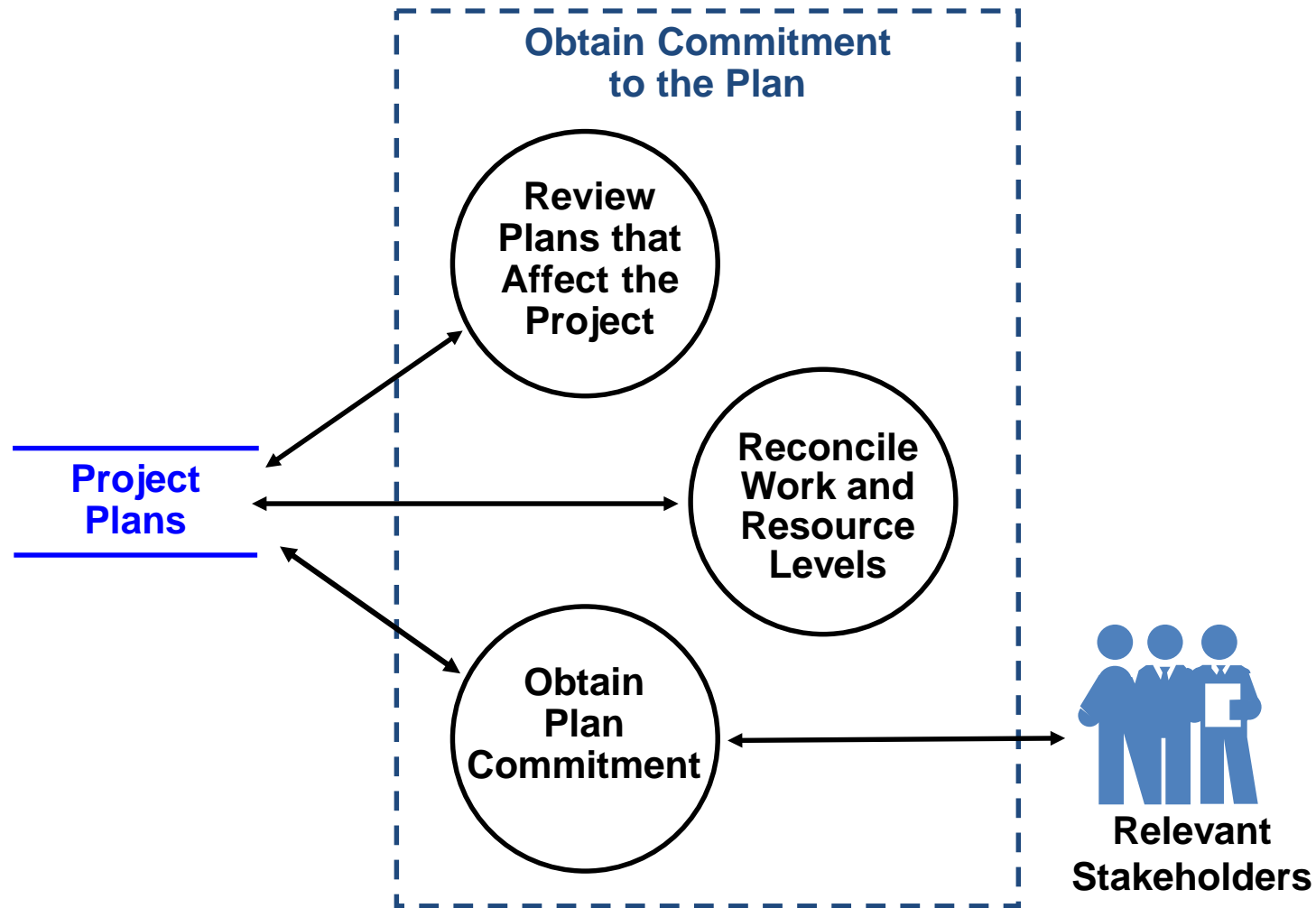
**SP 2.5 “Plan for Needed Knowledge and Skills”** - Knowledge and skills include domain knowledge and technical skills. Knowledge delivery to projects involves both training project personnel and acquiring knowledge from outside sources.

**SP 2.6 “Plan Stakeholder Involvement”** - This specific practice focuses on identifying the stakeholders for each phase of the product lifecycle and developing a plan for their involvement. Discuss the concept of stakeholders. A stakeholder is a group or individual that is affected by or in some way accountable for the outcome of an undertaking. Stakeholders include senior managers, project managers, project members, functional managers (e.g., systems engineering, software engineering, other disciplines), engineering staff, subcontractors, suppliers, customers, and end users. A stakeholder that is identified for involvement in a plan to perform specified activities or to receive





# Project Planning Context -6



# Project Planning Context -5

**SP 3.1 “Review Plans that Affect the Project”** - Other plans would normally be prepared for specialized disciplines and supporting activities such as quality assurance plans, configuration management plans, measurement and analysis plans, and discipline-specific subordinate plans for hardware, software, and systems engineering. Many of these plans are described by the Plan the Process generic practice in each of the PAs.

**SP 3.2 “Reconcile Work and Resource Levels”** – To establish a project that is feasible, obtain commitment from relevant stakeholders and reconcile differences between the estimated resources required for the project and the actual available resources. Where there are shortfalls, reconciliation is typically accomplished by lowering or deferring technical performance requirements, negotiating more resources, finding ways to increase productivity, adjusting the staff skill mix, revising schedules, etc.

# Project Planning Context -5

## SP 3.3 "Obtain Plan Commitment"

- *Obtaining Plan Commitment involves*
- *A two-way exchange (The individual or group making a commitment must have confidence that the work can be performed within cost, schedule, and performance constraints. Often, a provisional commitment is appropriate to allow the effort to begin and for research to be performed to obtain the confidence necessary to make a formal commitment. Commitment should be obtained from both organizations and the individuals responsible for accomplishing the work.)*
- Documenting all organizational commitments, both full and provisional to ensure the appropriate level of signatories
- Reviewing internal commitments with senior management as appropriate
- Reviewing external commitment with senior management as appropriate
- Identifying commitments regarding interfaces between elements of the project and interfaces with other projects and organizational units for monitoring

# Sampling the Generic Practices

## GP 2.2: Plan the Process

Establish and maintain the plan for performing the project planning process.

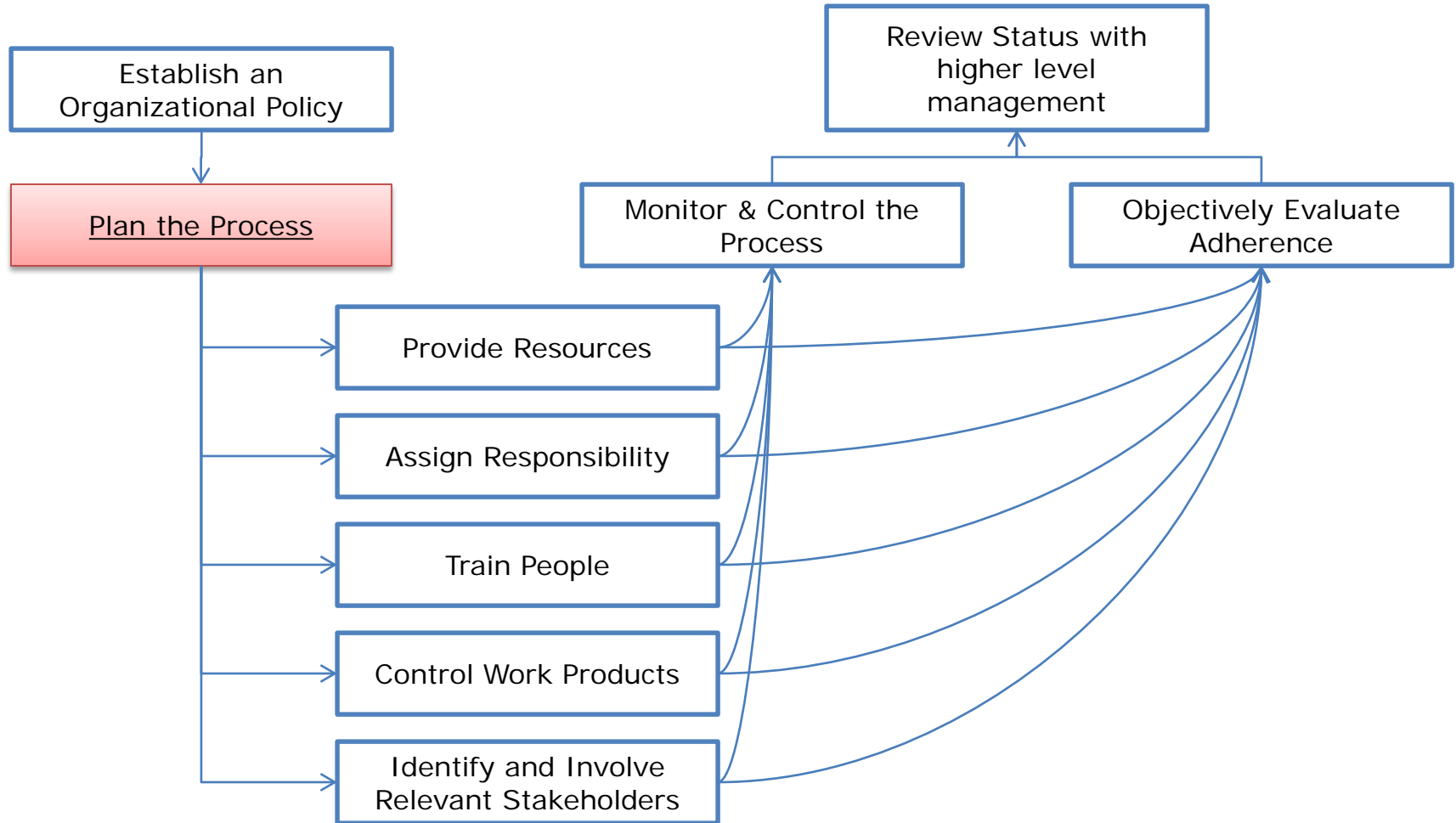
*Or .... PLAN THE PLAN !!!*

### *Elaboration for Project Planning*

Refer to Table 6.2 in Generic Goals and Practices in Part Two for more information about the relationship between generic practice 2.2 and the Project Planning process area.

**Генеричните практики (Generic practices = GP)** осигуряват институционализацията на процесите и по този начин гарантират, че дейностите от съответната процесна област ще бъдат ефективни, повтаряеми и дълготрайни.

# How PP relates to Generic Practices?



Source: Kiril Karaatanasov, ESI Center Bulgaria

# Project Planning "translated":

- **The Project Planning involves:**
  - Developing the project plan
  - Getting commitment to the plan
  - Maintaining the plan
- **Planning begins with requirements that define the product/project.**
- **Planning includes:**
  - Estimating the attributes of the work products/tasks
  - Determining the resources needed
  - Negotiating commitments
  - Producing a schedule
  - Identifying and analyzing project risks
- **The project plan will usually need to be revised to address:**
  - changes in requirements/commitments
  - inaccurate estimates
  - corrective actions
  - process changes
- **"Project plan" - the overall plan for controlling the project.**

# Project Planning actions (elaborate):

- Is there **WBS/Project work packages** based on project's workproducts?
- Work products to be **externally acquired/reused** identified?
- Technical approach of work products determined?  
(Development strategy – client-server/distributed, technologies)
- Duration, people, knowledge, inputs, outputs, infrastructure, etc. for the project determined and **how (what methods)?**
- Resources required estimated?
- Project life cycle/phases determined?
- **Project schedule and budget established?**
- Risks that can affect to the project **identified, documented and revised?**
- Project data management issues addressed?
- **Knowledge and skills** requirements identified and addressed?
- **Stakeholders** identified, and project tasks related to them **according their expertise?**
- Project plan established and **commitments to it identified and documented?**
- Is the project plan **reviewed and actualized?**



# Planning example:

sampling **Gantt Charts**

**Critical Path** Analysis – CPA

**PERT** - Program Evaluation and Review  
Technique:

shortest, most likely, longest  
(optimistic, realistic, pessimistic)

# SW Project Plan – example - 1

Figure 1. Gantt Chart Example: Planning a custom-written computer project

Task	Earliest start	Length	Type	Dependent on...
A. High level analysis	Week 0	1 week	Sequential	
B. Selection of hardware platform	Week 1	1 day	Sequential	A
C. Installation and commissioning of hardware	Week 1.2	2 weeks	Parallel	B
D. Detailed analysis of core modules	Week 1	2 weeks	Sequential	A
E. Detailed analysis of supporting modules	Week 3	2 weeks	Sequential	D
F. Programming of core modules	Week 3	2 weeks	Sequential	D
G. Programming of supporting modules	Week 5	3 weeks	Sequential	E
H. Quality assurance of core modules	Week 5	1 week	Sequential	F
I. Quality assurance of supporting modules	Week 8	1 week	Sequential	G
J. Core module training	Week 6	1 day	Parallel	C,H
K. Development and QA of accounting reporting	Week 5	1 week	Parallel	E
L. Development and QA of management reporting	Week 5	1 week	Parallel	E
M. Development of Management	Week 6	1 week	Sequential	I

**Step 1. List all activities in the plan**

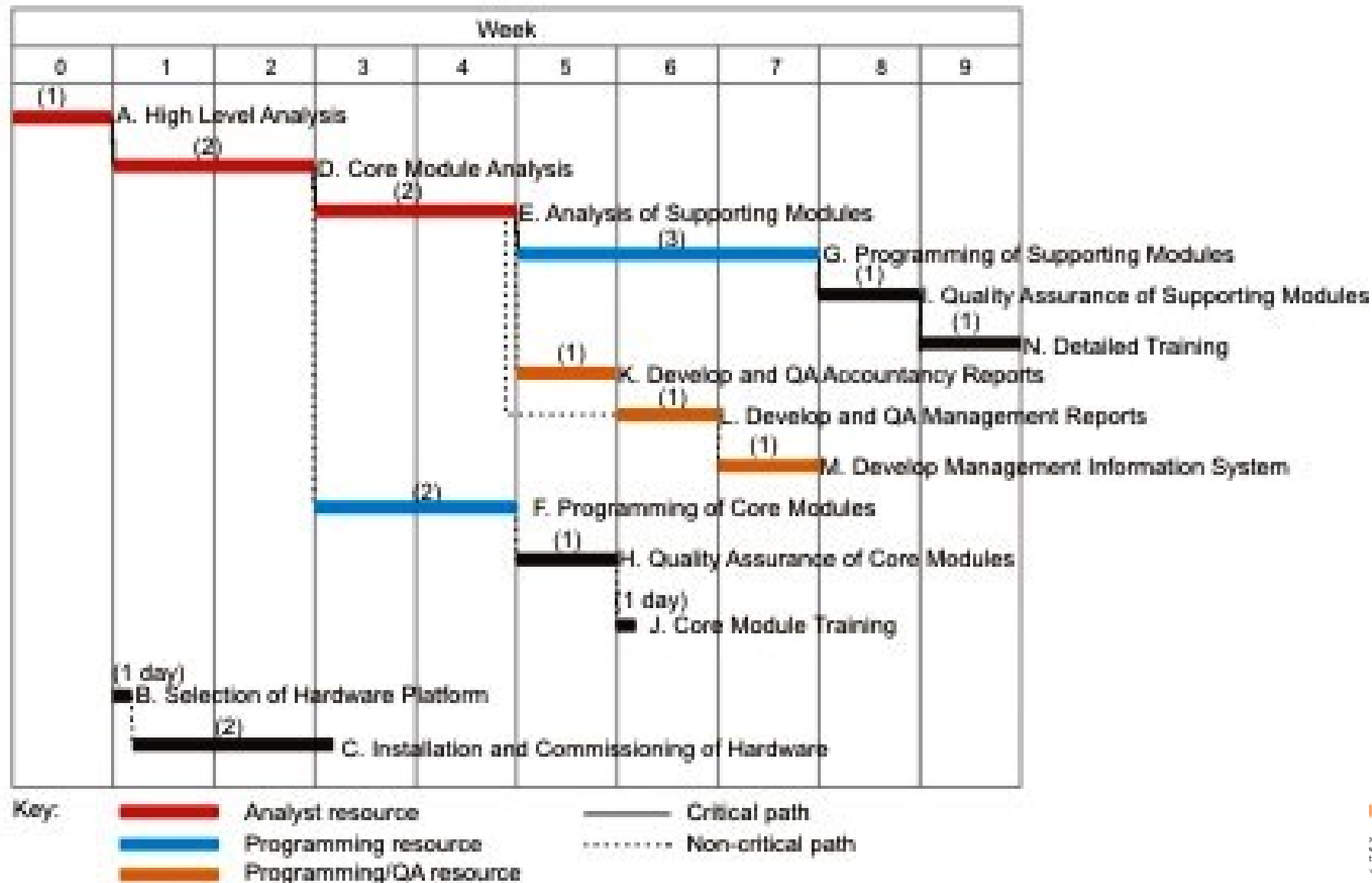
**Sequential and parallel activities**

Courtesy to [www.mindtools.com](http://www.mindtools.com)

# SW Project Plan – example - 2

## Gantt Chart

Figure 3: Critical Path Analysis: Activities Scheduled on a Gantt Chart



# SW Project Plan – example - 3

## Critical Path

[http://www.mindtools.com/pages/article/newPPM\\_03.htm](http://www.mindtools.com/pages/article/newPPM_03.htm)

By drawing this example Gantt Chart, you can see that:  
If all goes well, the project can be completed in 10 weeks.  
If you want to complete the task as rapidly as possible, you need:

- 1 analyst for the first 5 weeks.

- 1 programmer for 5 weeks starting week 4.

- 1 programmer/QA expert for 3 weeks starting week 6. Note: Activities L and M have been moved back a week. This does not affect the critical path, but it does mean that a single programming/QA resource can carry out all three of activities K, L and M.

Analysis, development and testing of supporting modules are essential activities that must be completed on time.

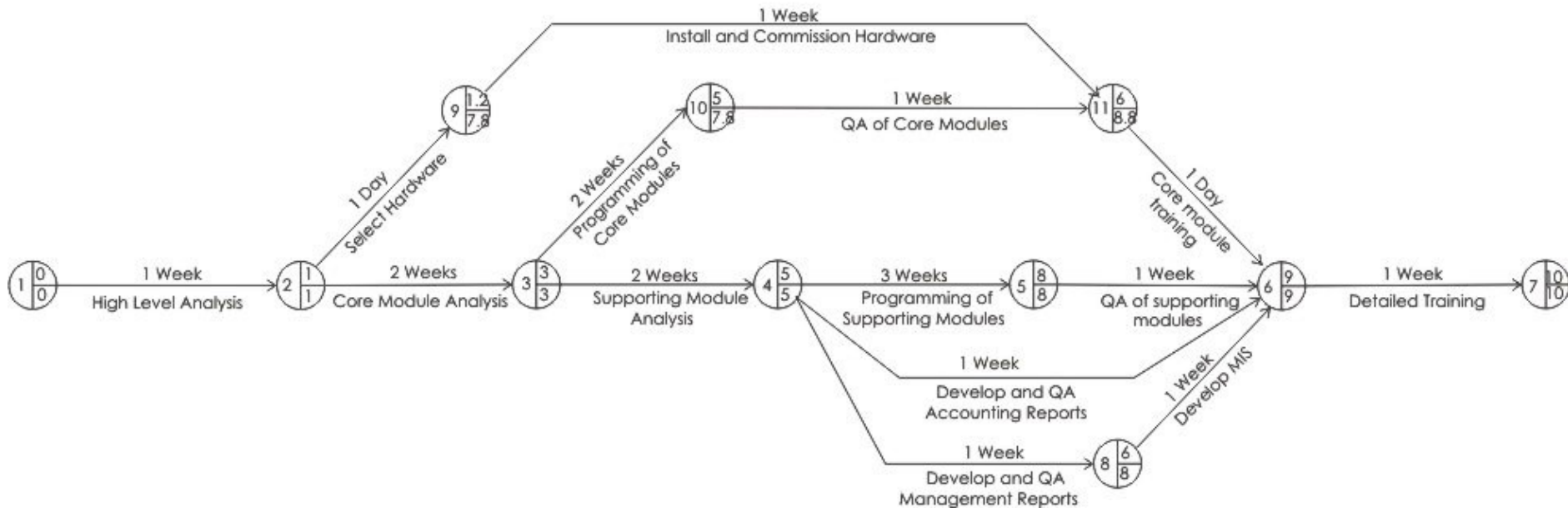
Hardware installation and commissioning is not time-critical as long as it is completed before the Core Module Training starts.

Courtesy to [www.mindtools.com](http://www.mindtools.com)

# SW Project Plan – example - 4

## Critical Path Analysis

Figure 5: Critical Path Analysis for Example Computer Project



Courtesy to [www.mindtools.com](http://www.mindtools.com)

# SW Project Plan – example - 5

## CPA and PERT

**Critical Path Analysis (CPA)** - method of assessing:

- What tasks must be carried out.
- Where parallel activity can be performed.
- The shortest time in which you can complete a project.
- Resources needed to execute a project.
- The sequence of activities, scheduling and timings involved.
- Task priorities.
- The most efficient way of shortening time on urgent projects.

**PERT** (Program Evaluation and Review Technique) is a variant of Critical Path Analysis that takes a more skeptical view of the time needed to complete each project stage:

shortest, most likely, longest

or ***optimistic, realistic, pessimistic***

Courtesy to [www.mindtools.com](http://www.mindtools.com)

# Project Management PAs (overview)

## Requirements management (REQM)

- SG1: Manage requirements

## Project Planning (PP)

- SG1: Establish Estimates
- SG2: Develop a project plan
- SG3: Obtain Commitment to the plan

## Project Monitoring and Control (PMC)

- **SG1: Monitor Project Against Plan**
- **SG2: Manage Corrective action to closure**

# PMC: Project Monitoring and Control

Целта на наблюдението и контрол на проекта (**Project Monitoring and Control=PMC**) е да осигури разбиране на \_\_\_\_\_ в проекта, така че да бъдат могат да бъдат предприети \_\_\_\_\_, когато изпълнението на проекта се отклонява значително от плана.



## SG 1: Monitor Project Against Plan

Actual performance and progress of the project are monitored against the project plan.

## SG 2: Manage Corrective Action to Closure

Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan.



# When Project Monitoring and Control Is Not Done Well...

Too much time is spent trying to determine **project status**.

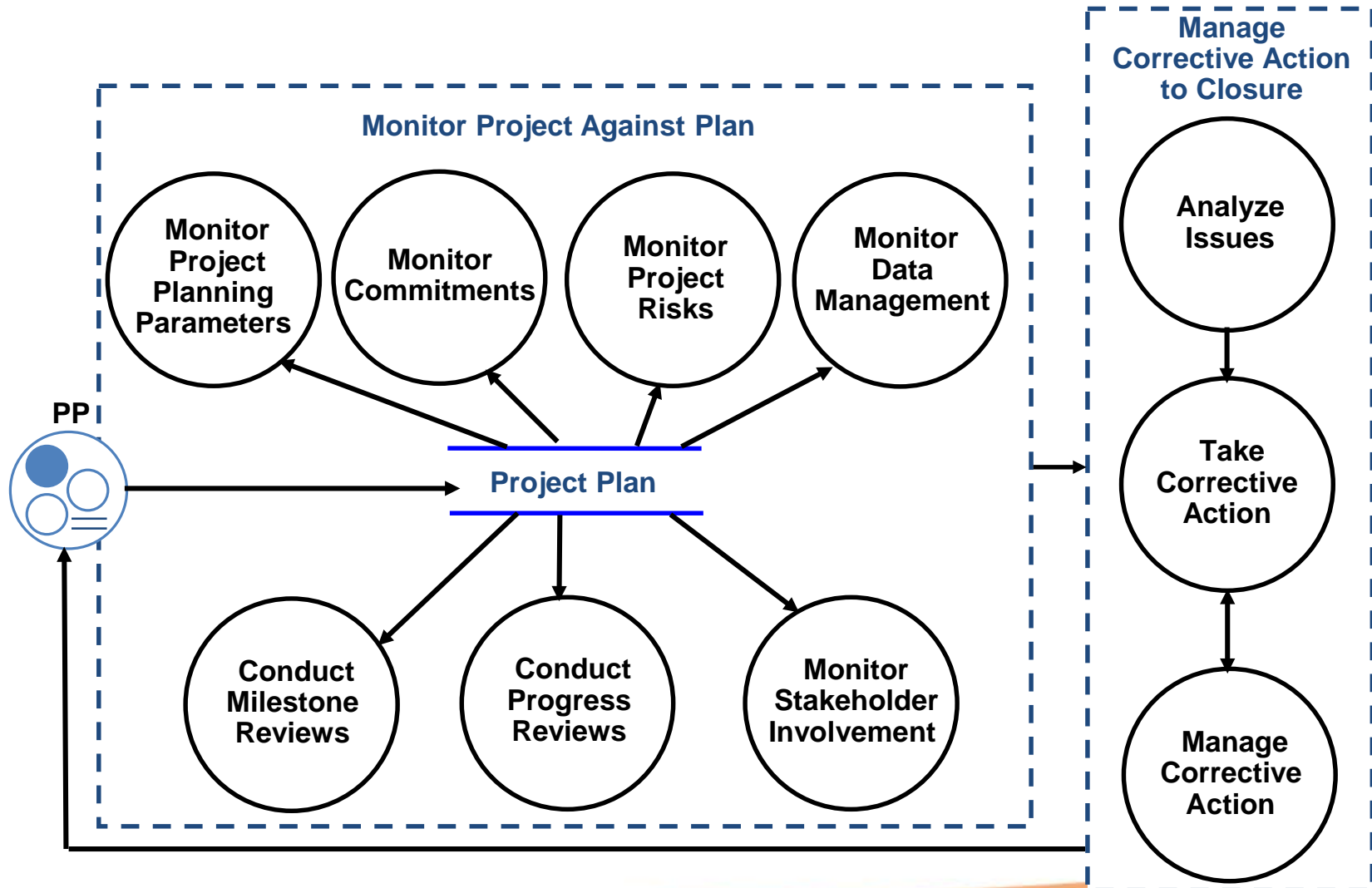
**Data** needed for management decisions are **not available** when needed.

**Corrective action** is not taken early when it is least expensive.

Lack of management insight makes project **results highly unpredictable**.

The **customer does not have confidence** in the project status reporting.

# Project Monitoring and Control Context



# Project Monitoring SPs

**PMC** also interacts with the Project Planning PA. **The project plan is developed in Project Planning and used in Project Monitoring and Control.**

## **SP 1.1 “Monitor Project Planning Parameters” –**

This practice monitors progress against the parameters established in the project plan (e.g., schedule, cost, expended effort, and resources).

**SP 1.2 “Monitor Commitments” -** Monitoring emphasizes identifying commitments that have not been satisfied or are at significant risk of not being satisfied and evaluating the impacts of these unsatisfied commitments.

# Project Monitoring SPs

**SP 1.3 “Monitor Project Risks”** - Monitoring project risks involves periodically reviewing the project’s documented risks in light of the current status and circumstances.

**SP 1.4 “Monitor Data Management”** - Monitoring data management involves periodically reviewing data management activities against their description in the project plan.

**SP 1.5 “Monitor Stakeholder Involvement”** - Monitoring stakeholder involvement includes periodically reviewing the status of stakeholder involvement and identifying and documenting significant issues and their impacts.

# Project Monitoring SPs

**SP 1.6 “Conduct Progress Reviews”** - This specific practice is distinct from conduct milestone reviews, which focuses on reviews at major project milestones and phase boundaries. Conducting progress reviews involves regularly communicating status on assigned activities and work products to relevant stakeholders and reviewing the results of collecting and analyzing measures for controlling the project.

**SP 1.7 “Conduct Milestone Reviews”** - Milestone reviews are conducted at meaningful points in the project’s schedule and include reviewing the commitments, plan, status, and risks of the project.

**Explain that the next 3 specific practices support the accomplishment of the specific goal, “Manage Corrective Actions to Closure.”**

# Project Monitoring SPs

**SP 2.1 “Analyze Issues”** - Analyzing issues involves gathering issues for analysis and analyzing them to determine the need for corrective action. Corrective action criteria are established in project planning.

**SP 2.2 “Take Corrective Action”** - Corrective actions are taken as necessary when issues are identified or when progress differs significantly from what was planned.

# Project Monitoring SPs

## **SP 2.3 “Manage Corrective Action” –**

Managing corrective action includes monitoring corrective actions for completion, analyzing the results of corrective actions to determine the effectiveness of the corrective action, and determining and documenting appropriate actions to correct deviations from planned results of corrective actions.

# The essence of PMC

- **PMC:**
  - monitoring activities
  - communicating status
  - taking corrective action
- **Progress** – at **prescribed milestones** (WBS/Schedule) comparing to the planned:
  - Actual work product and task attributes
  - Effort, cost, and schedule
- When actual status **deviates significantly** – corrective actions
- Corrective actions may include **re-planning (PP)**



# PMC Actions

- **Monitored:**
  - Progress against the schedule
  - Cost, expended effort, staffing and training
  - Actual resources usage
- **Deviations documented?**
- Internal and external commitments **regularly reviewed?**
- **Risks status** regularly reviewed/communicated to relevant stakeholder?
- Data management tasks regularly reviewed?
- **Progress reviews:**
  - Task status communicated?
  - Results documented?
- **Milestone reviews** conducted?
- Manage **corrective actions to closure**
  - Issues analyzed and documented?
  - Corrective actions tracked to closure?
  - Results analyzed?



VIA 9GAG.COM

# Remember - Generic practices ML2?

GP2.1: Establish an Organizational Policy

GP2.2: Plan the Process

GP2.3: Provide Resources

GP2.4: Assign Responsibility

GP2.5: Train People

GP2.6: Manage Work Products

GP2.7: Identify and Involve Relevant Stakeholders

GP2.8: **Monitor and Control the Process**

GP2.9: Objectively Evaluate Adherence

GP2.10: Review Status with Higher Level Management

# Sampling the Generic Practices

## GP 2.8: Monitor and Control the Process

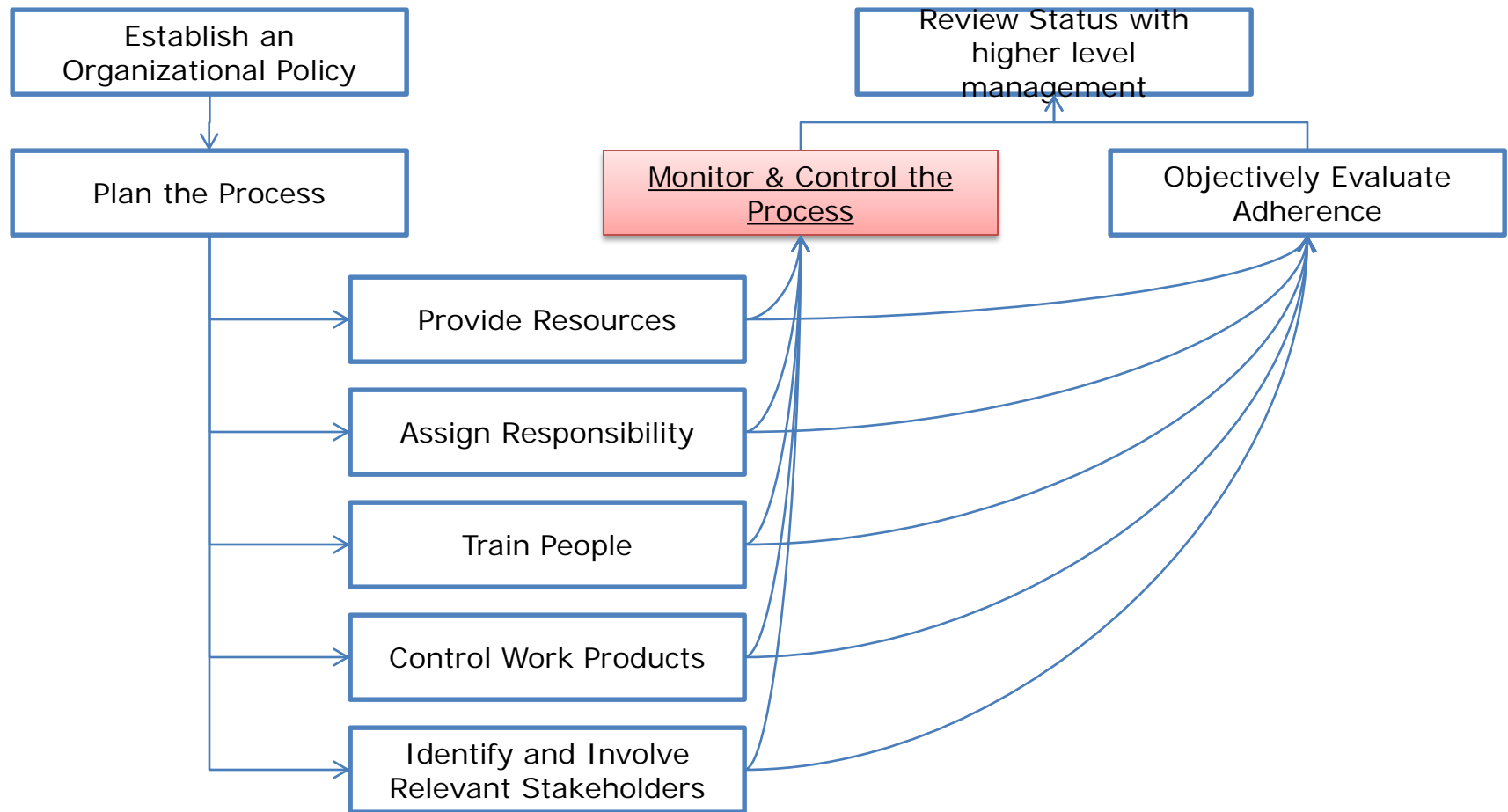
Monitor and control the project monitoring and control process against the plan for performing the process and take appropriate corrective action.

### *Elaboration for Project Monitoring and Control*

Examples of measures and work products used in monitoring and controlling include the following:

- number of open and closed corrective actions
- schedule with status for monthly financial data collection, analysis, and reporting
- number and types of reviews performed
- review schedule (planned versus actual and slipped target dates)
- schedule for collection and analysis of monitoring data

# How PMC relates to Generic Practices?



Source: Kiril Karaatanasov, ESI Center Bulgaria



# Just to mention SAM

## (Supplier Agreement Management)

*The purpose of Supplier Agreement Management (SAM) is to **manage the acquisition of products and services** from suppliers.*



### **SG 1: Establish Supplier Agreements**

Agreements with the suppliers are established and maintained.

### **SG 2: Satisfy Supplier Agreements**

Agreements with suppliers are satisfied by both the project and the supplier.

# The essence of SAM

**Applies** to the acquisition of:

- products/components** that are **delivered** to the project's customer

- significant products/components **not delivered** to the project's customer (for example, development tools and test environments).

**Does not apply** when supplier is part of the team

Suppliers:

- in-house vendors

- fabrication capabilities and laboratories

- commercial vendors

The acquired product is delivered to the project from the supplier and **becomes part of the products delivered to the customer**



# SAM Practices for next lecture:

Type of acquisition (COTS, contract, in-house, from the customer) determined?

Supplier **selection based on evaluation?**

**Criteria for evaluation** established/documented?

Criteria for evaluation of proposals?

Agreement with supplier documented?

Agreement revised during project?

Criteria of evaluation of COTS?

Risk analysis performed on COTS?

Monitoring activities defined in the agreement?

Technical/management reviews with supplier performed?

Acceptance test/verification performed and results documented?

# Next: Supporting PAs ML2:

- Requirements Management
- Project Planning
- Project Monitoring & Control
- **Process and Product Quality Assurance**
- **Measurement & Analysis**
- **Configuration Management**
- Supplier Agreement Management